of cancer (1) hereditary factors, and (2) chemical actions exerted by an internal secretion.

We could show that the hereditary factors are not identical with the internal secretion and do not act by changing the number of corpora lutea and their activity, but that their point of attack is somewhere else. It appears probable that with the cooperation of hereditary conditions all those internal secretions are factors in the origin of cancer which initiate or sustain continuous or periodic growth processes. In other cases mechanical stimulation of growth may take the place of chemical stimulation and again in others a combination of both may be present. Whether in addition to these factors definitely established there is still another factor (microorganisms?) present, and which relation this last-named hypothetical factor bears to the other two factors are at present unknown. But whether or not such an additional factor enters, we can be certain that the two first named sets of factors are sufficiently strong to determine to a great extent the frequency of cancer in mice.

Leo Loeb
Department of Comparative Pathology,
Washington University

A NEW METHOD OF SELECTING TOMATOES FOR RESISTANCE TO THE WILT DISEASE

Perhaps the most serious disease of tomatoes in the southern states is that caused by *Fusarium lycopersici,* the one that is commonly known as the tomato wilt. The causative fungus lives in the soil and attacks the plants through the roots and later grows up through the fibrovascular bundles into the stems. In common with similar diseases of other plants, such as the wilts of cotton, watermelon, etc., the only practical method of control now known is in the use of varieties, or strains, that are resistant to the disease. By saving seed from healthy plants in a badly infected field for several seasons, strains can be obtained which show considerable resistance to the disease. This method of selecting the strains, however, has several serious drawbacks: (1) A large acreage of tomatoes is required as a large percentage of the plants which are set in the field die with the wilt. (2) Many of the plants in the field do not come in contact with the wilt fungus during the season and so do not have a chance to show whether they are resistant to the disease. (3) Resistant plants in the field are readily pollinated by the susceptible plants. (4) The time necessary to obtain a wilt-resistant strain is too long.

While studying the disease in Louisiana, an attempt has been made to improve on our common method of selecting resistant plants by selecting in the seed bed. This has been accomplished by taking advantage of the fact that soil diseases infect plants better if the soil is first sterilized and then inoculated with a pure culture of the disease organism. In ordinary unsterilized garden soil, even if it is heavily inoculated with the tomato wilt fungus, not many of the plants will show the wilt to any extent before it is time to place them in the field. The presence of bacteria and other fungi seems to have an inhibitory effect on the wilt fungus. If, however, the soil is first sterilized by heat and then heavily inoculated with the wilt fungus just before planting, the disease will develop so well that most of the susceptible plants will be killed before they are large enough to be placed in the field. By growing the plants in this manner, only plants showing resistance are placed in the field. This saves a great deal of field space and also allows a selection from an almost unlimited number of plants. This also assures the presence of the wilt fungus on the roots of every plant.

To show how this method of selection works in practise, results of some experiments may be briefly given. Having by the old method of selection obtained a strain that showed considerable resistance to the wilt disease, this was compared by the seed bed method with three standard varieties of tomatoes. The seed of each variety were planted side by side in reinoculated sterilized soil. Different cultures of the fungus from different localities were also used in order to see if they would affect the varieties differently. In the following

table are given the percentages of living plants and of wilt-free plants of each variety sixty-eight days after planting. Most of the living plants that were diseased could be told by an external examination, but for these results all living plants were cut and examined for the presence of the discolored fibrovascular bundles.

Variety.	Culture *A*.		Culture *B*.		Culture *C*.		Culture *D*.	
	Living, Per Cent.	Healthy, Per Cent.	Living, Per Cent.	Healthy, Per Cent.	Living, Per Cent.	Healthy, Per Cent.	Living, Per Cent.	Healthy, Per Cent.
Stone	35.3	11.8	75.0	55.0	44.7	25.5	71.4	57.1
Acme	14.3	0.0	42.9	28.6	31.3	21.9	65.8	31.6
Earliana......	32.3	3.2	63.5	36.5	37.3	17.7	96.0	70.0
Wilt-resistant	62.5	31.3	.818	56.8	68.2	34.1	95.1	78.0

This table shows the comparatively greater resistance of the wilt-resistant variety as compared to the others, and it also shows the large percentage of susceptible plants that could be eliminated before setting in the field.

Although the investigations on this method are far from complete, it seems well at this time to put it into the hands of other workers with the hope that it may be found useful.

C. W. EDGERTON

LOUISIANA AGRICULTURAL EXPERIMENT STATION, BATON ROUGE, LA.

DO MOVEMENTS OCCUR IN THE VISUAL CELLS AND RETINAL PIGMENT OF MAN?[1]

THE statement is commonly found in text-books of gross[2] and microscopical[3] anatomy, as well as in some texts of physiology,[4] that the retinal pigment of the human eye undergoes positional changes in light and in darkness. The pigment, which, in the dark, forms a compact layer next to the choroid, is said to migrate towards the external limiting membrane in the light, thereby forming processes which interdigitate with the rods and cones. If not explicitly stated, it is at least implied that this response is well marked and the actual migration extensive.

This view is so generally accepted as expressing a commonplace of retinal physiology that it is well worth while to examine the facts upon which its validity rests.

That photomechanical changes take place in the retinal pigment of anuran amphibians, a fact first established independently by Boll[5] and by Kühne[6] on the frog in 1877, may be substantiated by any one who will perform the necessary experiments. Similar results, in many cases even more striking, were obtained on fishes (Stort, '86).[7] Angelucci ('78)[8] likewise first reported this condition to hold for *Triton* as a type of urodele amphibian, and Stort ('87),[9] using the pigeon for material, again presented the earliest demonstration in the retina of birds.

When reptiles and mammals are considered, on the other hand, the literature at once becomes contradictory. Angelucci ('90),[10] however, reported a rather limited pigment migration in the retina of *Testudo marina*, and Chiarini ('06)[11] also states that a distinct but

[1] Contributions from the Zoological Laboratory of the Museum of Comparative Zoology at Harvard College, No. 263.

[2] *E. g.*, R. Howden, 1913, in Cunningham's "Anatomy," 4th ed., p. 817. E. A. Spitzka, 1910, in Gray's "Anatomy," 18th ed., p. 1106. Piersol, G. A., 1906, "Human Anatomy," p. 1463.

[3] *E. g.*, Bailey, F. R., 1913, "Text-book of Histology," 4th ed., p. 556. Piersol, G. A., 1913, "Normal Histology," 10th ed., p. 348.

[4] *E. g.*, Halliburton, W. D., 1910, "Handbook of Physiology," 9th ed., p. 843. Starling, E. H., 1912, "Principles of Human Physiology," p. 630 (by implication).

[5] Boll, F., 1877, *Monatsber. d. k. preuss. Akad. d. Wiss. zu Berlin*, pp. 72–74.

[6] Kühne, W., 1877, *Untersuch. a. d. physiol. Inst. d. Univ. Heidelberg*, Bd. 1, pp. 15–103, Taf. 1.

[7] Stort, A. G. H., Van Genderen, 1886, *Bericht über d. 18. Versamm. d. Ophthal. Gesell. zu Heidelberg*, pp. 43–49.

[8] Angelucci, A., 1878, *Arch. f. Anat. u. Physiol., Physiol Abt.*, pp. 353–386.

[9] Stort, A. G. H., Van Genderen, 1887, *Arch. neérland. d. Sci. exact et nat.*, Tom. 21, pp. 316–386.

[10] Angelucci, A., 1890, *Untersuch. z. Naturlehre d. Menschen u. d. Thiere*, Bd. 14, pp. 231–357.

[11] Chiarini, P., 1906, *Arch. ital. de Biol.*, Tom. 45, pp. 337–352.